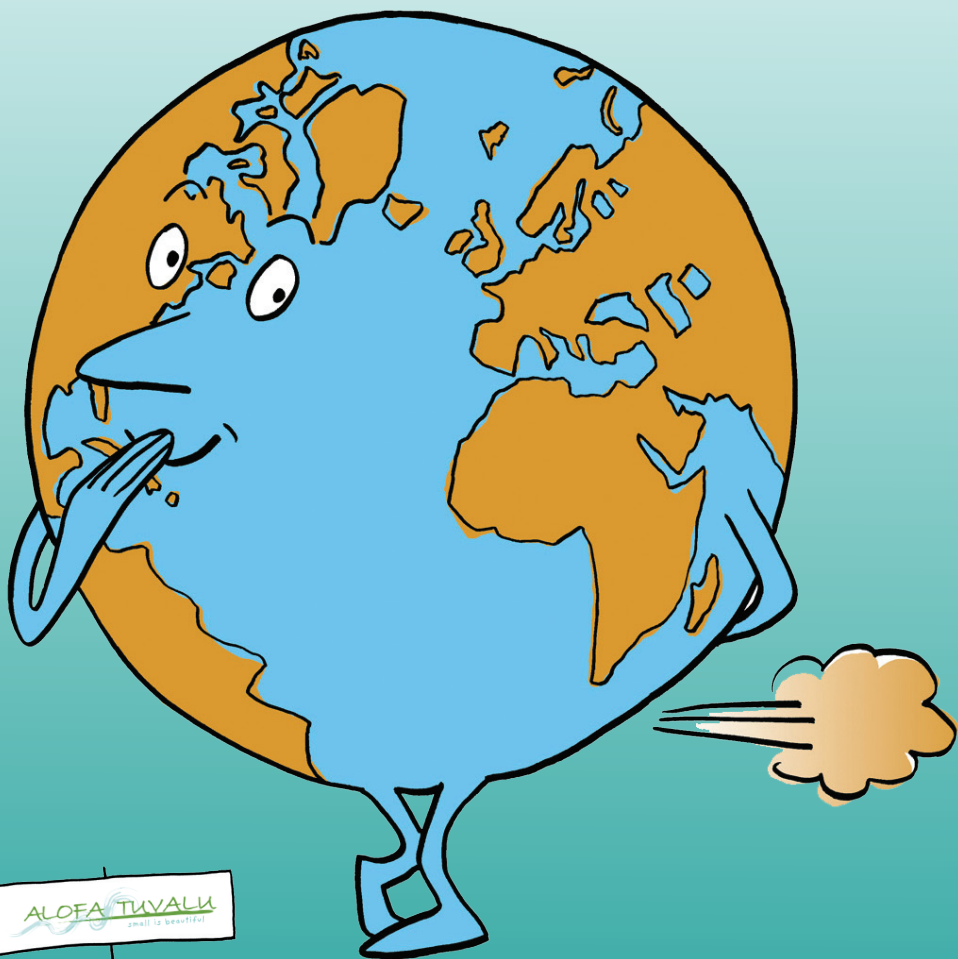


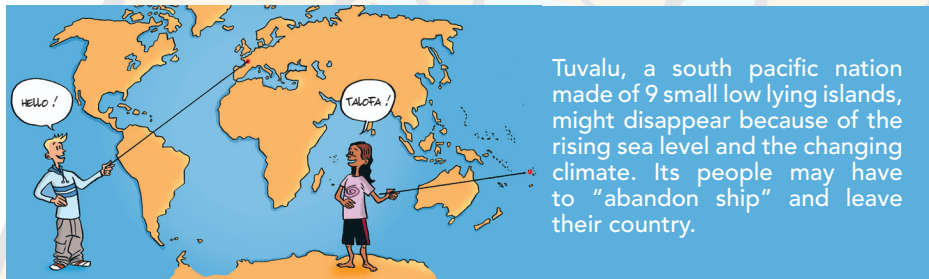
BIOGAS - WHAT A BLAST!!!



A STORY OF THE REAL-WORLD EXAMPLE OF TUVALU
WHERE PEOPLE LEARNED HOW TO POWER CARS AND MOTORBIKES
WITH COCONUT OIL AND COOK WITH BIOGAS.

OUR PLANET IS DROWNING...

Glaciers are melting, seas are rising, storms, floods and droughts are increasing, species are disappearing and if we don't act now, millions of people will have to leave their home.



How did it come to this?

Simple: to stay warm, the Earth lets the sun's rays enter the atmosphere and prevents them from going back into space. How? With what we call green house gas, such as vapour, carbon dioxide or methane. Together these gases act like a car window and keep the sun's heat inside the atmosphere. Without them, temperature would be -18°C (0°F) instead of the average 15°C (59°F). This is known as "the Greenhouse Effect"

The problem is that we humans are burning more and more fossil fuels (coal, gas, diesel, etc) creating more of these greenhouse gases. It's getting hotter around the planet and the climate is going crazy. This is what we call "Climate Change".

The good thing is that we know how to do things differently.

Hi, MY NAME IS SIB,
FOR "SMALL IS BEAUTIFUL". YES I AM... BEAUTIFUL... LOL...
AND SO IS TUVALU. I'M ONE OF THE HEROES OF "OUR PLANET UNDER WATER",
THE COMIC BOOK... AVAILABLE IN MANY LANGUAGES... TO SAVE TUVALU
AND OTHER TERRITORIES, WE NEED EVERYONE, ALL THE CHILDREN OF THE WORLD...
BECAUSE THERE'S A LOT TO DO!



FROM www.alofatuvalu.tv
AND www.mtaterre.fr

LET'S START FROM THE BEGINNING



The greek word "energeia" means "power in action". It could be the energy of our thoughts, our muscles as well as... the energy from machines.

HUMAN AND ANIMAL ENERGY COMES FROM THE CARBON CONTAINED IN THE THINGS THEY EAT..



Millions of years ago, to live, eat and move around humans used their own energy and that of their animals. Men learned how to make fire. Then, using wind, their boats sailed, and with wind and water their mills turned. Wood was used for heating and cooking, and animal oil for lights. Humans used whatever they could get their hands on to create energy.

FOSSIL FUELS

At the end of the 18th century, men went deeper underground to look for resources. Coal replaced wood. Burnt in a furnace, it produces steam that supplies energy to engines, lights and heating systems. Then, when humans found the way to move electricity through wires, slowly but surely fossil fuel energy powered our homes.



At the beginning of the 20th century, everything started going faster with the use of gas and petroleum. Like coal, they're fossil fuels. Buried deep in the earth and oceans, they took millions of years to form... so they can't be replaced in a lifetime. We say they are "non renewable". Fossil fuels are responsible for 80% of our carbon dioxide emissions. Today we use energy for everything: to eat, move around, work, wash, dress, to get cooler or warmer, or play on our phones and pads.

Although we are becoming aware that we are harming the climate, there are more and more humans on earth using more and more energy. In 3 generations, we've used up half of the world's easily available fossil fuels. It will cost more and more to get to them creating more pollution and one day there won't be any left...

Another good reason to learn how to do things differently!

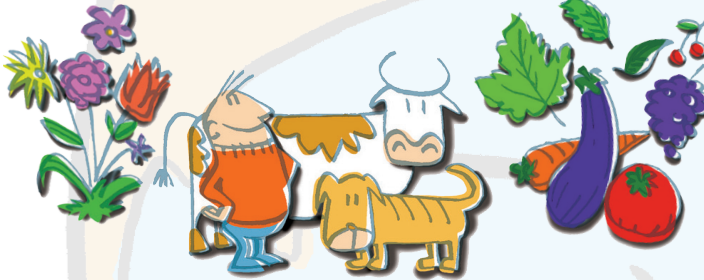
RENEWABLE ENERGIES



Nature offers many renewable energy

sources that can be used without polluting: solar, wind, geothermal energies, rivers, oceans energies and... **BIOMASS**, made from plants and organic waste.

WOOD IS A RENEWABLE RESOURCE AS LONG AS THE NUMBER OF TREES PLANTED IS GREATER THAN THE NUMBER OF TREES CUT.



Biomass is the organic matter from plants (wood, flowers, vegetables) and animals (poo, grease, fur, etc). It renews itself rapidly. Biomass, like gas, coal and petroleum, is made of carbon. When burnt it transforms into energy. The advantage of biomass is that while growing, a plant absorbs carbon from the atmosphere and soil which is released into the atmosphere when burnt. In the end, the plant absorbs as much carbon as it emits. Therefore, using biomass energy sustainably does not increase the quantity of green house gases in the atmosphere.

Another advantage: plants produce the oxygen we breathe.

Last but not least, with biomass, one can also produce agrofuels - also called biofuels: **biodiesel**, **bioethanol** and **gases**.



Tuvalu has a dream: to become fossil fuel independent. With the Alofa Tuvalu NGO, people in Tuvalu learned how to create biofuels (biodiesel and bioethanol) and biogas from coconut trees, plants and animal waste.



WITH 1KG OF BIOMASS,
A LED BULB LIGHTS FOR 20 HOURS, A TV CAN WORK
FOR AROUND 2 HOURS AND A CAR CAN DRIVE FOR 1 KM...
WITHOUT HARMING THE CLIMATE...



BIODIESEL AND BIOETHANOL

Biofuels are liquid or gaseous fuels produced from biomass.

Biodiesel can replace petroleum-based diesel. It's produced from vegetable oil (coconut, colza, soy, sunflower...) or from animal grease, transformed into biodiesel by a chemical process called esterification. Biodiesel can be used alone in engines or mixed with diesel. A diesel engine car can also run on colza or coconut oil!

Bioethanol can be used for gasoline engines. It's an alcohol made from plants that contain sugar (beets, sugar canes, coconuts, wheat, corn etc). It can be mixed with gasoline up to 85%. Bioethanol is the most used biofuel in the world.

In Tuvalu, coconut biodiesel is ideal for electric generators. Toddy - the alcohol derived from coconut tree sap - was transformed into bioethanol and was successfully tested on motorbikes and small fishing boats.



Tuvalu has enough coconut trees to make local use of biofuels a practical reality, if they replant from time to time. In some bigger countries, like the USA or Brazil which actively grow agrofuels, it can become a problem when there aren't enough fields left to grow food. The solution? - like in Tuvalu - food first, fuel second! To help get around this problem, some scientists are for example working on biofuels from algae.

THE BIOMASS GASES

Organic and animal waste has been used to produce gas for quite a long time.

There are at least two ways:



Gasification consists of producing a mix of gases by burning dry, fibrous organic wastes (wood, sawdust, coconut shells etc) at a very high temperature, in a kind of oven called a gasifier. The gas can be used in a stove for cooking or in a generator to produce electricity.

Methanisation or digestion produces methane, the same gas as our farts, also called **BIOGAS**.

BIOGAS

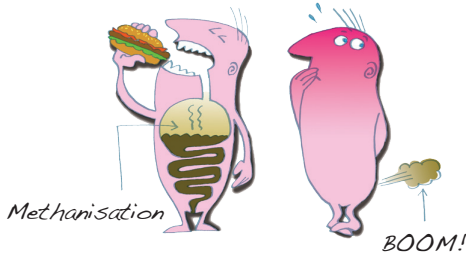


In swamps, manure or inside the guts of animals and humans, a gas called methane or biogas is formed. It comes from the breaking down, also called decomposition or methanisation, of organic waste: wet wood, vegetable and fruit scraps, grease, fur and hair or... poo.

Methane is a powerful greenhouse gas, but when produced and stored in a digester, it doesn't get released into the atmosphere and also provides a renewable form of energy.

A biogas digester functions like our stomach.

During digestion, what we've eaten produces a gas (the fart... about 1 liter per day) and a solid (the poo).



Bacteria, living in an oxygen free environment, decompose the contents of the digester and produce compost and biogas. This process takes several weeks, but if the digester is fed every day, just like your stomach, it will produce compost and gas every day after. Biogas is used to cook on a stove or to produce electricity. Compost is a natural fertilizer, ideal for gardens and fields.

In Tuvalu, Alofa Tuvalu installed 12 biogas digesters on 3 of the 9 islands. The first one was made of brick and collects pig manure. The others, made of 2 plastic containers, one inside the other, digest any kind of organic waste and the biogas is used to cook with every day.



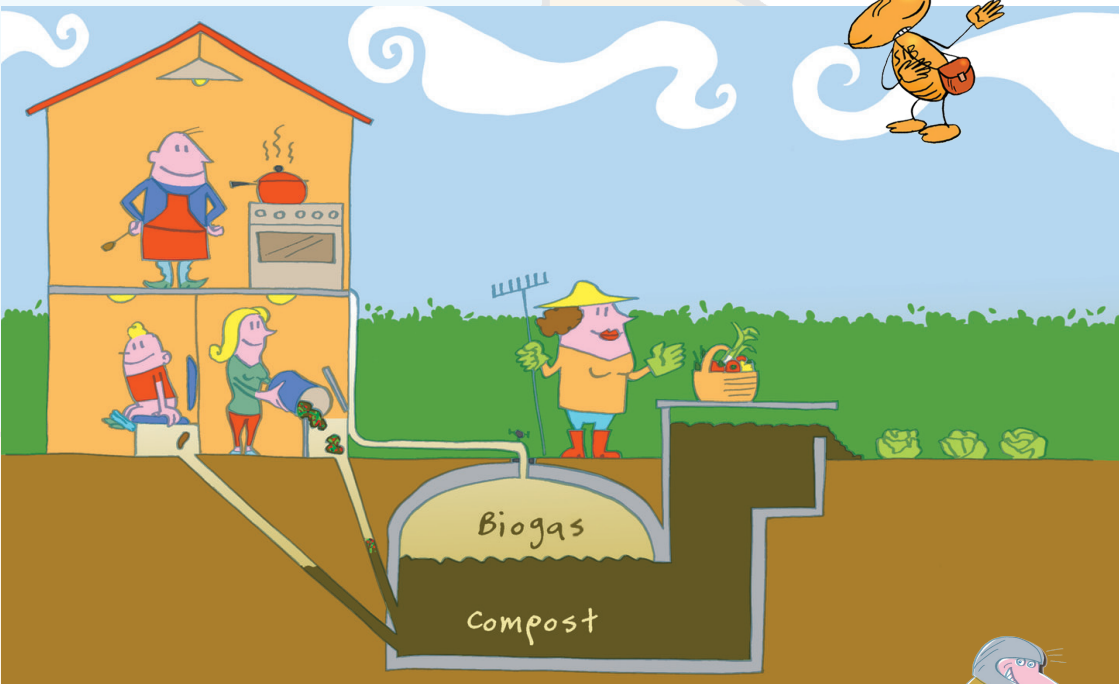
WE COULDN'T INVENT IT EVEN IF WE WANTED TO: CACA ("POO" IN GREEK AND FRENCH) IS THE ROMAN GODDESS OF FIRE!

Biogas in the world... The first biogas engines appeared in 1870. And during World War II, the German army used trucks that ran on biogas produced from farmyard manure. Today, in China 20 million families run their personal digesters from human poo! In Europe, biogas is used to light and heat city blocks and to run cars and buses. In the UK and the US, dairy farms produce their biogas from cow manure while, in France, it's also being produced with sauerkraut (pickled chopped cabbage) and sausage waste.





FREE ENERGY DOES TAKE WORK! THE DIGESTER HAS TO BE FILLED DAILY WITH ORGANIC WASTE AND WATER. AND THE GAS PRODUCED MUST BE USED REGULARLY. TO AVOID HAVING TO EMPTY THE DIGESTER AND START AGAIN: NO SALT, NO SOAP OR ANY OTHER DETERGENT CAN ENTER THE MIX, AS THESE STOP THE DIGESTIVE PROCESS.



"WHAT CAN I DO WITH MY ORGANIC WASTE?"

- In cities, it's hard to safely make biogas but I can:
 - Compost my organic rubbish and feed the plants
 - Ask if we can install a composter in my school and make a vegetable garden to put the compost in
- In country areas I can:
 - Check out existing biogas plants in my area
 - Explain the process to my parents and talk to farmers that I know...



BOOM!

DID YOU KNOW?

Cows burps and farts are made of gases, and methane is one of them. Farm animals create 14,5% of worldwide human-caused greenhouse gas releases that add to climate change. Scientists say if we feed the cows with linseed instead of corn or soy, we could cut back the amount of methane that they produce by 20%. Hmmm, some also say, that it might make the animals sick. Well, all considered... nothing's better for a cow than grazing in a meadow...

REMEMBER:
WHAT IS GOOD FOR THE PLANET
IS ALSO GOOD FOR YOUR WALLET!!

Say "no to waste"



TO REDUCE MY GREENHOUSE GAS EMISSION, I DESERVE AN A IF :

- **Food:** I buy local produce and choose seasonal fruits and vegetables. I eat less meat and avoid industrialized frozen food. I put a cover on pots and pans when cooking (it heats 4 times faster and uses 4 times less energy).
- **Cooling and Heating:** I turn off the AC and use natural ventilation whenever possible and prefer a fan to AC (one of the most harmful appliances for the climate). In cold regions, if I feel chilly, I put on a sweater. 19°C (66,2°F) is enough. I hunt down drafts coming under doors or windows...and stop them.
- **Waste:** I respect the 7R rule: I Rethink the way I buy; I Refuse what I don't need; I Reduce my waste by choosing items with the least amount of packaging or... I chose Refill; I have my things and clothes Repaired; I Reuse and always have some bags on me when I go shopping; I sort my waste so that paper, cardboard, metal, glass and plastic can be Recycled. Globally, about 1,7 billion tons of waste are produced each year. Top 3 wasters are: the United States (800kg a year per person), China and Japan. Best recycler is Austria with 63% of waste being recycled.
- **Water:** I turn off the tap when using the soap or brushing my teeth. I check for leaky taps. I don't flush after only 1 pee. I take a quick shower (30 liters) rather than a bath (150l, 5 times more) and save the cold water while it gets warm to use it to water the plants.
- **Electricity:** I turn off the lights when I leave a room and don't leave electric or electronic equipment on standby. I don't put warm food in the fridge and make sure the fridge door is properly closed.
- **Transport:** I walk or ride my bike rather than take a car, I take the train rather than the plane; I ask my parents if the family car's engine is well tuned and the tires properly inflated; I suggest carpooling with friends to save a ride.
- **Above all:** I set the example; I give a presentation to my class on how to protect the environment; I explain to my friends, especially to the ones who say that environmentally conscious behavior isn't worth the effort...



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Produced by

